What is claimed is:

1. A composite oxide, comprising: agglomerated particles having an average particle diameter of 20 μm or less and being composed of a plurality of metallic element oxides which are in form of fine particles having an average diameter of 50 nm or less, said agglomerated particles having a surface and an inner portion whose metallic element distributions differ with each other.

2. The composite oxide according to claim 1, wherein the plurality of metallic elements are Al and at least one element selected from the group consisting of Ce and Zr.

3. The composite oxide according to claim 2, wherein at least a part of CeO_2 and ZrO_2 form a solid solution.

4. The composite oxide according to claim 1, wherein the plurality of metallic elements are Al, Zr and Ti.

5. The composite oxide according to claim 4, wherein at least a part of ZrO_2 and TiO_2 form a solid solution.

6. The composite oxide according to claim 2, wherein said agglomerated particles further comprise a rare-earth element oxide, and the rare-earth element oxide is solved in Al_2O_3 in an amount of 70 mol % or more.

7. The composite oxide according to claim 4, wherein said agglomerated particles further comprise a rare-earth element oxide, and the rare-earth

element oxide is solved in Al_2O_3 in an amount of 70 mol % or more.

8. The composite oxide according to claim 1, wherein the plurality of metallic elements are at least two elements selected from the group consisting of Al, Ce, Zr, Y, Si, Ti, Mg and Pr.

9. The composite oxide according to claim 8, wherein a solving ratio of Y_2O_3 in CeO_2 is 10 mol % or less, and a solving ratio of Y_2O_3 in ZrO_2 is 90 mol % or more.

10. The composite oxide according to claim 8, wherein said agglomerated particles further comprise a rare-earth element oxide, excepting Y_2O_3, and the rare-earth element oxide is solved in Al_2O_3 in an amount of 70 mol % or more.

11. The composite oxide according to claim 6, wherein the rare-earth element oxide is La_2O_3.

12. The composite oxide according to claim 10, wherein the rare-earth element oxide is La_2O_3.

13. A composite oxide, comprising:

agglomerated particles having an average particle diameter of 20 μm or less, in which first oxide-phase fine particles having an average diameter of 50 nm or less, and second oxide-phase fine particles being different from the first oxide-phase fine particles and having an average particle diameter of 50 nm or less, are agglomerated,

said first oxide-phase forming a crystal having an aspect ratio

of 30 or less and being highly dispersed each other with said second-phase fine particles to constitute said agglomerated particles.

14. The composite oxide according to claim 13 further comprising third oxide-phase fine particles being different from the first oxide-phase particles and the second oxide-phase fine particles.

15. A composite oxide, comprising:

agglomerated particles having an average particle diameter of 20 μm or less, in which first oxide-phase fine particles having an average diameter of 100 nm or less and second oxide-phase fine particles being different from the first oxide-phase fine particles and having an average particle diameter of 30 nm or less are agglomerated;

said first oxide-phase fine particles having pores between the fine particles, in the pores which a major part of said second oxide-phase fine particles are dispersed, the pores having a median pore diameter of from 5 to 20 nm, 50% or more of all the pores falling in a range of $\pm$ 2nm of the median diameter.

16. The composite oxide according to claim 15 further comprising third oxide-phase fine particles being different from the first oxide-phase fine particles and the second oxide-phase fine particles, a major portion of the third oxide-phase fine particles being dispersed in the pores.

17. The composite oxide according to claim 13, wherein metallic elements, constituting the first oxide phase, the second oxide phase and the third oxide phase are at least two metallic elements selected from the group consisting of Al, Ce, Zr, Ti, Mg, La, Pr and Si.

18. The composite oxide according to claim 15, wherein metallic elements, constituting the first oxide phase, the second oxide phase and the third oxide phase are at least two metallic elements selected from the group consisting of Al, Ce, Zr, Ti, Mg, La, Pr and Si.

19. The composite oxide according to claim 13, wherein the respective oxides have crystalline diameters of 10 nm or less after calcining them in air at 700 ℃ for 5 hours.

20. The composite oxide according to claim 15, wherein the respective oxides have crystalline diameters of 10 nm or less after calcining them in air at 700 ℃ for 5 hours.

21. The composite oxide according to claim 16, wherein the respective oxides have crystalline diameters of 10 nm or less after calcining them in air at 700 ℃ for 5 hours.

22. A catalyst for purifying an exhaust gas, comprising: a catalytic ingredient being loaded on the composite oxides set forth in claims 1.

23. A catalyst for purifying an exhaust gas, comprising: a catalytic ingredient being loaded on the composite oxides set forth in claims 13.

24. A catalyst for purifying an exhaust gas, comprising: a catalytic ingredient being loaded on the composite oxides set forth in claims

15.

25. A catalyst for purifying an exhaust gas, comprising: a catalytic ingredient being loaded on the composite oxides set forth in claims 16.

26. A catalyst for purifying an exhaust gas, comprising:

a support substrate;

a first catalytic layer being formed on a surface of the support substrate, and being composed of a first support including the first oxide phase set forth in claim 13, and a catalytic ingredient being loaded on the first support; and

a second catalytic layer being formed on a surface of the first catalytic layer, and being composed of a second support including the second oxide phase set forth in claim 13, and a catalytic ingredient being loaded on the second support;

at least one of the first support and the second support including agglomerated particles having an average particle diameter of 20 μ m or less, in which a plurality of metallic element oxides being in form of fine particles and having an average particle diameter of 50 nm or less are dispersed, said agglomerated particles having a surface and an inner portion whose metallic element distributions differ with each other.

27. A catalyst for purifying an exhaust gas, comprising:

a support substrate;

a first catalytic layer being formed on a surface of the support substrate, and being composed of a first support including the first

oxide phase set forth in claim 15, and a catalytic ingredient being loaded on the first support; and

a second catalytic layer being formed on a surface of the first catalytic layer, and being composed of a second support including the second oxide phase set forth in claim 15, and a catalytic ingredient being loaded on the second support;

at least one of the first support and the second support including agglomerated particles having an average particle diameter of 20 μm or less, in which a plurality of metallic element oxides being in form of fine particles and having an average particle diameter of 50 nm or less are dispersed, said agglomerated particles having a surface and an inner portion whose metallic element distributions differ with each other.

28. The catalyst according to claim 26, wherein the plurality of metallic elements are at least two elements selected from the group consisting of Al, Ce, Zr, Ti, Mg, La and Si.

29. The catalyst for purifying an exhaust gas according to claim 28, wherein said agglomerated particles are included in the first support.

30. The catalyst for purifying an exhaust gas according to claim 28, wherein a CeO_2-ZrO_2 solid solution is included in the inner portion of said agglomerated particles.

31. The catalyst for purifying an exhaust gas according to claim 28, wherein Al_2O_3, being stabilized by La_2O_3, is included in the surface of said agglomerated particles.

32. The catalyst for purifying an exhaust gas according to claim 28, wherein hollow Al_2O_3 is included in the second support.

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33. A catalyst for purifying an exhaust gas, comprising:

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a support substrate;

a support layer being formed on a surface of said support substrate, and including agglomerated particles havign an average particle diameter of 20 μm or less in which a plurality of metallic element oxides being in form of fine particles and having an average particle diameter of 50 nm or less are dispersed, and zeolite particles, said agglomerated particles having a surface and an inner portion whose metallic element distributions differ with each other; and

a catalytic ingredient loaded on said support layer.

34. The catalyst for purifying an exhaust gas according to claim 33, wherein said support layer being formed as a two-layered construction includes at least a lower layer, and an upper layer being formed on a surface of the lower layer, the lower layer being composed of the zeolite particles, the upper layer and being composed of the agglomerated particles.

35. The catalyst for purifying an exhaust gas according to claim 33, wherein the agglomerated particles comprise a first metallic oxide, being composed of at least one element selected from the group consisting of Al, Si and Ti, and a second metallic oxide being composed of at least one element selected from the group consisting of Ce and Pr.

36. The catalyst for purifying an exhaust gas according to claim 35, wherein said agglomerated particles further comprise a third metallic oxide being composed of at least one element selected from the group consisting of La, Nd, Mg and Ca.

37. The catalyst for purifying an exhaust gas according to claim 33, wherein said catalytic ingredient is loaded on said agglomerated particles.

38. The catalyst for purifying an exhaust gas according to claim 33, wherein said agglomerated particles have crystalline diameters of 10 nm or less after calcining them in air at 700 ℃ for 5 hours.

39. A process for producing a composite oxide, comprising the steps of:

preparing a plurality of aqueous solutions of metallic acid salts;

adding the plurality of aqueous solutions successively to an alkaline aqueous solution, which can neutralize the total amount of the metallic acid salts, thereby generating precipitates; and

calcining the precipitates.

40. The process for producing a composite oxide according to claim 39, wherein the precipitates, which are generated successively, are subjected to an aging treatment while putting them in a suspension state in which water or a solution containing water serves as a dispersion medium, or in a system in which water is present sufficiently.

41. A process for producing a composite oxide, comprising the steps

of:

preparing a plurality of aqueous solutions of metallic acid salts;

mixing the respective aqueous solutions of the metallic acid salts with an alkaline solution, thereby forming precipitates respectively;

mixing the respective precipitates, thereby preparing a precipitates mixture; and

calcining the precipitates mixture.

42. The process for producing a composite oxide according to claim 41, wherein at least one of the respective formed precipitates is subjected to an aging treatment while putting it in a suspension state in which water or a solution containing water serves as a dispersion medium, or in a system in which water is present sufficiently, and a precipitates mixture, in which the precipitates are mixed, is calcined.

43. A process for producing a composite oxide, comprising the steps of:

preparing a plurality of aqueous solutions of metallic acid salts;

mixing at least one of the aqueous solutions of the metallic acid salts with an alkaline solution, thereby forming precipitates;

subjecting at least one of the precipitates to an aging treatment while putting it in a suspension state in which water or a solution containing water serves as a dispersion medium, or in a system in which water is present sufficiently;

adding the rest of the aqueous solutions of the metallic acid salts to the formed precipitates thereafter, thereby further forming precipitates; and

calcining the resulting precipitates subsequently.

44. The process for producing a composite oxide according to claim 43, before said calcining step, further comprising the step of: subjecting the resulting precipitates to an aging treatment while putting them in a suspension state in which water or a solution containing water serves as a dispersion medium, or in a system in which water is present sufficiently.

45. A process for producing a catalyst for purifying an exhaust gas, wherein a catalytic ingredient is included in at least one of the aqueous solutions of the metallic acid salts set forth in claims 39.

46. A process for producing a catalyst for purifying an exhaust gas, wherein a catalytic ingredient is included in at least one of the aqueous solutions of the metallic acid salts set forth in claims 41.

47. A process for producing a catalyst for purifying an exhaust gas, wherein a catalytic ingredient is included in at least one of the aqueous solutions of the metallic acid salts set forth in claims 43.

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